Make-up Exam 3

Cl 35.45

C 12.01

There is only one best answer to each question.

1) Carbon tetrachloride (CCl_4) has a chlorine-to-carbon mass ratio of 11.8:1. If a sample of carbon tetrachloride contains 20 g of chloride, what mass of carbon does it contain?
   a. 0.59 g
   b. 14.76 g
   c. 1.69 g
   d. 236 g

First solution: $\frac{Cl}{C} = \frac{11.8}{1} \Rightarrow \frac{20\ g}{C} = \frac{11.8}{1} \Rightarrow C = \frac{20 \times 1}{11.8} = 1.69\ g$

Second solution: $?\ gC = 20\ g\,Cl \times \frac{1\ mol\,Cl}{35.45\ g\,Cl} \times \frac{1\ mol\,C}{4\ mol\,Cl} \times \frac{12.01\ g\,C}{1\ mol\,C} = 1.69\ g$

2) Write a chemical formula for a compound that contains two chlorine atoms to every one oxygen atom.
   a. ClO_2
   b. Cl_2O
   c. $2ClO$
   d. $Cl(O_2)_2$

2 Cl 1 O → Cl_2O_1

3) What is the correct chemical formula for lithium phosphate and iron (II) oxide?
   a. Li_3PO_3, Fe_2O_3
   b. Li_3PO_4, FeO
   c. Li_3PO_4, Fe_2O_3
   d. Li_3PO_3, FeO

Li^{+} PO_4^{3-} → $Li_3(PO_4)_1$ (3, 1)

Fe^{2+} O^{2-} → Fe_2O_2 (2, 2) ⇒ FeO

C 12.01 H 1.01 Cl 35.45 F 19.00 Br 79.90

4) What is the formula mass for CCl_2F_2 and hydrobromic acid?
   a. 120.91, 96.91
   b. 120.91, 80.91
   c. 97.47, 96.91
   d. 97.47, 80.91

HBr

$CCl_2F_2 = (C \times 1) + (Cl \times 2) + (F \times 2) = 120.91$ amu (12.01, 35.45, 19.00)

$HBr = 1.01 + 79.90 = 80.91$ amu

5) Write a formula for the compound that forms between potassium and chloride ions.
   a. $NaClO_3$
   b. $KClO_3$
   c. $NaCl$
   d. KCl

K^{+} Cl^{-}

6) Name the compound $Mg(NO_3)_2$
   a. Magnesium nitrate
   b. Magnesium nitrite
   c. Magnesium (II) nitrate
   d. Magnesium (II) nitrite

Mg^{2+} NO_3^{-}

Magnesium nitrate

7) Which of the following elements do NOT occur naturally as diatomic molecules?

a. H
b. B
c. Cl
d. I

8) Determine the formula mass of Li_3N

a. 43.81
b. 34.83
c. 48.97
d. 41.00

$Li_3N_1 = (3 \times Li) + (1 \times N) = 34.83$ amu (Li: 6.94; N: 14.01)

9) Name the acid $HClO_2$

a. Hydrochloric acid
b. Chlorous acid
c. Chloric acid
d. Hydrochlorous acid

ClO_2^- : chlorite $\Rightarrow$ Base name of polyatomic ion + -ous + acid

10) Name the compound SF_6

a. ~~Mono~~sulfur hexafluoride
b. Sulfur fluoride
c. ~~Mono~~sulfur fluoride
d. Sulfur hexafluoride

11) How many atoms are there in 20 mol argon?

a. 1.20×10^{21}
b. 6.022×10^{23}
c. 1.20×10^{25}
d. 1.20×10^{-21}

$$? \text{ atoms} = 20 \text{ mol Ar} \times \frac{6.022 \times 10^{23} \text{ atoms}}{1 \text{ mol Ar}} = 1.20 \times 10^{25} \text{ atoms}$$

12) A sample of pure silver has a mass of 200 g. How many moles of silver are in the sample?

a. 0.54
b. 0.98
c. 1.02
d. 1.85

Ag: 107.87

$$? \text{ mol Ag} = 200 \text{ g Ag} \times \frac{1 \text{ mol Ag}}{107.87 \text{ g Ag}} = 1.85 \text{ mol Ag}$$

13) Which sample contains the largest number of atoms?

a. 100 g Na
b. 100 g H
c. 100 g He
d. 100 g Ne

$$? \# \text{ atoms} = 100 \text{ g Na} \times \frac{1 \text{ mol Na}}{22.99 \text{ g Na}} \times \frac{6.022 \times 10^{23} \text{ atoms}}{1 \text{ mol Na}}$$

since the grams are the same in all 4, we can compare their atomic mass.

Atomic mass of H (1.01) < Atomic mass of He (4.00) < Atomic mass of Ne (20.18) < Atomic mass of Na (22.99)

H atoms > # He atoms > # Ne atoms > # Na atoms

14) How many moles of N are in 10 mol of $Mg(NO_3)_2$?

a. 20
b. 60
c. 10
d. This problem cannot be solved with the information provided.

? mol N = 10 mol $Mg(NO_3)_2$ × $\frac{2 \text{ mol N}}{1 \text{ mol } Mg(NO_3)_2}$ = 20 mol N

N 14.01

H 1.01

15) A compound is decomposed in the laboratory and produces 1.40 g N and 0.20 g H. What is the empirical formula of the compound?

a. NH
b. N_7H
c. NH_2
d. N_2H

? mol N = 1.4 g N × $\frac{1 \text{ mol N}}{14.01 \text{ g N}}$ = 0.0999 mol N

? mol H = 0.20 g H × $\frac{1 \text{ mol H}}{1.01 \text{ g H}}$ = 0.1980 mol H

$N_{\frac{0.0999}{0.0999}}$ $H_{\frac{0.1980}{0.0999}}$

$NH_{1.98}$ ⇒ NH_2

16) Which of the following names is correct?

a. PBr_5: Phosphorus (V) pentabromide
b. P_2O_3: Phosphorus trioxide
c. SF_4: Monosulfur hexafluoride
d. NF_4: Nitrogen tetrafluoride

molecular ← a
diphosphorous trioxide ← b

17) Is the following statement True or False?

Oxyacids are classified into two types, depending on the endings of the oxycations that they contain.

anion

a. True
b. False

18) What is the mass of 5.94×10^{20} H_2O_2 molecules?

a. 0.033 g
b. 0.0594 g
c. 0.001 g
d. 0.018 g

? g H_2O_2 = 5.94×10^{20} H_2O_2 molecules × $\frac{1 \text{ mol } H_2O_2}{6.022 \times 10^{23} \text{ \# molecules}}$ × $\frac{(2 \times 1.01) + (16 \times 2) \text{ g } H_2O_2}{1 \text{ mol } H_2O_2}$ = 0.03356 g

19) What is the formula mass of $Mg(NO_3)_2$?

a. 5993.65
b. 148.33
c. 86.32
d. 178.96

$Mg(NO_3)_2$ = (1 × Mg) + (2 × N) + (6 × O) = 148.33 amu

Mg: 24.31, N: 14.01, O: 16.00

20) What is the mass percent composition of oxygen in N_2O_5?

a. 25.9 %
b. 68.6 %
c. 74.1 %
d. 29.6 %

Mass percent composition of O = $\frac{5 \times 16.00}{(2 \times 14.01) + (5 \times 16.00)}$ × 100% = 74.06 %

21) Is the following statement True or False?

A mole has to be a ~~small~~ large number because atoms are so ~~large~~ small.

a. True
b. False

22) What are polyatomic ions?

a. Ions that are themselves composed of a group of atoms with an overall charge
b. A ~~metal~~ and one or more nonmetals together in a chemical formula
c. Two or more ~~cations~~ paired with two or more ~~anions~~
d. Ions that are themselves composed of a group of atoms with total ~~charge of zero~~

23) Which acid has the higher mass percent composition of O?

a. $HClO_2$
b. $HClO_3$
c. H_2SO_4
d. $H_4C_2O_2$

a: $\frac{2 \times O}{(H \times 1) + (Cl \times 1) + (2 \times O)} \times 100\% = 46.74\%$

b: $\frac{3 \times O}{(H \times 1) + (Cl \times 1) + (3 \times O)} \times 100\% = 56.83\%$

c: $\frac{4 \times O}{(H \times 2) + S + (4 \times O)} \times 100\% = 65.25\%$

d: $\frac{2 \times O}{(H \times 4) + (2 \times C) + (2 \times O)} \times 100\% = 53.28\%$

24) What is the mass of H in 10 g of H_2SO_4?

a. 0.40 g
b. 0.10 g
c. 485.54 g
d. 0.21 g

$H_2SO_4 = (H \times 2) + (1 \times S) + (4 \times 16) = 98.08 \text{ g/mol}$

$? \text{ g H} = 10 \text{ g } H_2SO_4 \times \frac{1 \text{ mol } H_2SO_4}{98.08 \text{ g } H_2SO_4} \times \frac{2 \text{ mol H}}{1 \text{ mol } H_2SO_4} \times \frac{1.01 \text{ g H}}{1 \text{ mol H}} = 0.2059 \text{ g} \cong 0.21 \text{ g}$

25) Which of the following is an empirical formula?

a. $C_6H_{12}O_6$ ← Molecular (empirical: CH_2O)
b. C_4H_4 ← Molecular (empirical: CH)
c. H_2O_6 ← Molecular (empirical: HO_3)
d. TiO_2